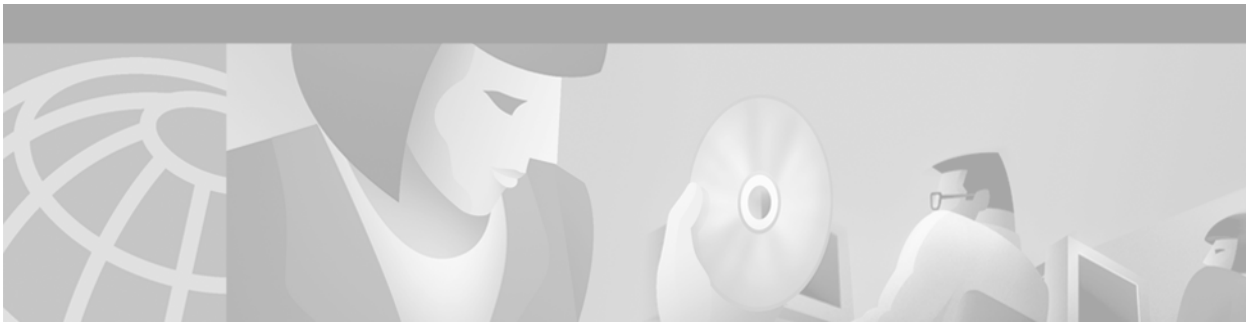


Configuring Frame Relay-ATM Interworking

Note This new chapter applies only to the Cisco MC3810 multiservice access concentrator for Cisco IOS Release 12.1. This feature is not currently supported on any other platform.

Frame Relay-ATM Interworking enables Frame Relay voice or data traffic to be encapsulated in ATM cells. For a description of the commands used to configure Frame Relay-ATM Interworking, refer to the *Cisco IOS Wide-Area Networking Command Reference* publication. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

There are two types of Frame Relay-ATM Interworking:

- FRF.5 Frame Relay-ATM Network Interworking
- FRF.8 Frame Relay-ATM Service Interworking

FRF.5 Frame Relay-ATM Network Interworking

Note FRF.5 is only supported on the Cisco MC3810 multiservice access concentrator for Cisco IOS Release 12.1.

The following sections provide details about FRF.5 Frame Relay-ATM Network Interworking. To configure FRF.5, perform the tasks in the following sections:

- FRF.5 Concepts
- Configuring FRF.5

For examples of configuring FRF.5, see the section "FRF.5 Configuration Examples" later in this chapter.

Note FRF.5 is supported only over Frame Relay or ATM PVCs. It is not supported on SVCs.

FRF.5 Concepts

With FRF.5, you can transport Frame Relay traffic over an ATM cloud via a virtual interface within the Cisco MC3810. By using the encapsulation process, you can migrate from Frame Relay to ATM, or you can tunnel Frame Relay traffic across an ATM backbone to a second Cisco MC3810 or other Frame Relay device and then extract the ATM traffic back to Frame Relay. The Frame Relay traffic is encapsulated in the ATM data cells.

Figure 23 shows how the virtual interface in the Cisco MC3810 converts Frame Relay traffic to ATM traffic.

Figure 23 FRF.5 Virtual Interface

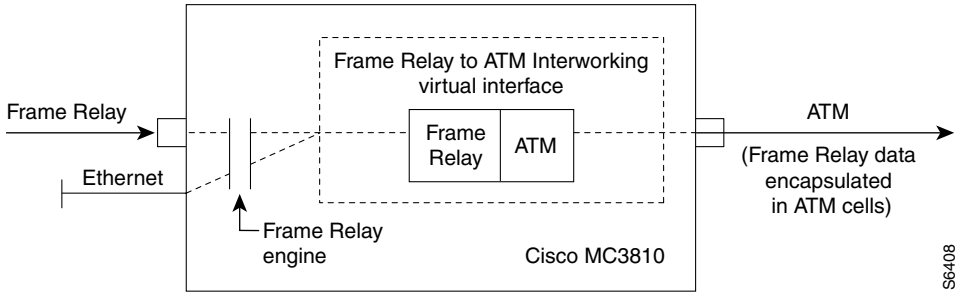


Figure 24 shows encapsulated Frame Relay traffic within ATM cells on the Cisco MC3810, tunneled across the ATM backbone, and then extracted from ATM on a second Cisco MC3810.

Figure 24 Using FRF.5 to Tunnel Frame Relay Traffic over ATM

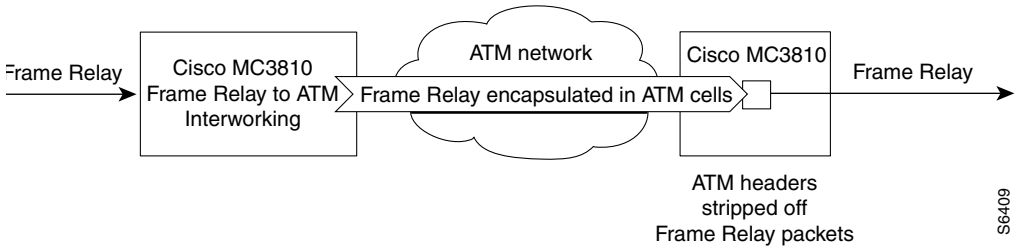
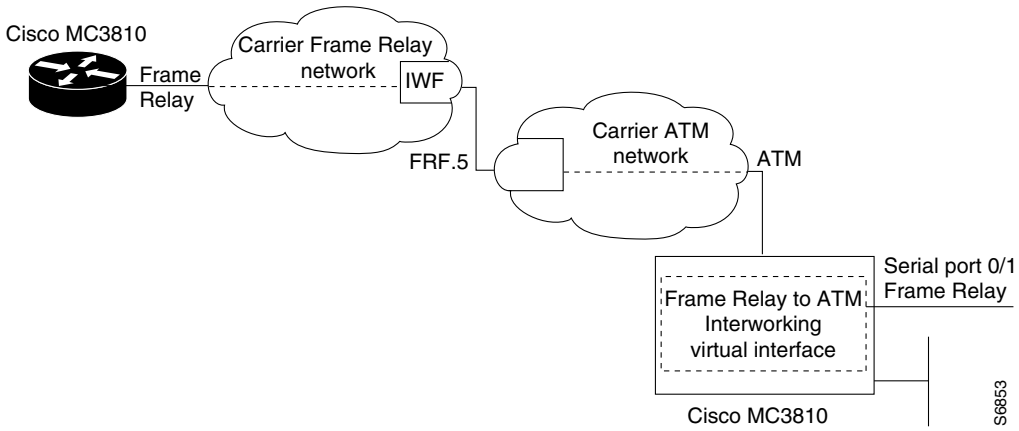


Figure 25 shows the FRF.5 interworking function (IWF) enabled between a Frame Relay and ATM carrier networks.

Figure 25 FRF.5 Between Frame Relay and ATM Carrier Networks



Configuring FRF.5

To configure FRF.5 Frame Relay-ATM Network Interworking, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`router(config)# interface fr-atm number`	Creates a Frame Relay-ATM Interworking interface.
Step 2	`router(config-if)# encapsulation frame-relay [ietf]`	Configures the interface for Frame Relay encapsulation. Specify the **ietf** option only if RFC 1490 is supported.
Step 3	`router(config-if)# frame-relay interface-dlci dlci [voice-encap size]`	Configures the Frame Relay data-link connection identifier (DLCI), which must match on both sides of the ATM network.
Step 4	`router(config-if)# frame-relay route in-dlci out-interface out-dlci [voice-encapsulation size]`	Configures the Frame Relay route. If the DLCI is for voice, specify the **voice-encapsulation** option and data segmentation size. For recommended data segmentation sizes, see Table 7.
Step 5	`router(config-if)# no keepalive`	Turns off Frame Relay keepalive packets.
Step 6	`router(config-if)# fr-atm connect dlci dlci atm0 pvc [name] [vpi/vci] [clp-bit {map-de | 0 | 1}] [de-bit {no-map-clp | map-clp}]`	Maps a Frame Relay DLCI to an ATM PVC name or VPI/VCI. The encapsulation type of the current interface must be Frame Relay or Frame Relay 1490 (IETF). The ATM interface must be set to ATM 0.
Step 7	`router(config)# controller {t1 | e1} 0`	Selects T1/E1 controller 0. (ATM only on controller 0.)
Step 8	`router(config-controller)# mode atm`	Indicates the controller supports ATM encapsulation, and creates virtual ATM interface 0 for ATM PVCs.

	Command	Purpose
Step 9	`router(config)# interface atm0 point-to-point`	Configures ATM interface 0 for a point-to-point network.
Step 10	`router(config-if)# ip address ip-address mask`	Assigns the IP address and subnet mask to the interface.
Step 11	`router(config-if)# pvc [name] vpi/vci`	Creates an ATM PVC and enters configuration mode.
Step 12	`router(config-if-atm-pvc)# encapsulation aal5 mux frame-relay`	Sets encapsulation of the ATM PVC.

Note UBR, UBR+, VBR-NRT, and VBR-RT services are mutually exclusive. Assign only one of these services on a VC at one time.

To perform traffic shaping on the VC, use one of the following commands:

Command	Purpose
`router(config-if-atm-pvc)# ubr output value [input value]`	Assigns the UBR values for this VC.
or	
`router(config-if-atm-pvc)# ubr+ output-peak-value output-minimum-rate-value [input-peak-value] [input-minimum-rate-value]`	Assigns UBR+ values for this VC.
or	
`router(config-if-atm-pvc)# vbr-nrt output-pcr output-scr output mbs [input-pcr][input scr][input mbs]`	Assigns VBR-NBR values for this VC.
or	
`router(config-if-atm-pvc)# vbr-rt peak-rate average-rate [burst]`	Assigns VBR-RT values for voice traffic-supporting VC.

If you are using FRF.5 to send data only, your configuration tasks are complete. However, if you are using FRF.5 to send voice only or voice and data, see the section "Configuring FRF.5 for Voice" later in this chapter.

Note To calculate the voice encapsulation data segmentation size, use the access rate of either the local or remove device, whichever is slower. If the segmentation size is too large for either device, the slower device will not handle the large data segmentation size, and the circuit will be congested.

Table 7 lists port access rates and recommended data segmentation sizes.

Table 7 Recommended Data Segmentation Sizes

Port Access Rate	Recommended Data Segmentation Size[1]
64 kbps	80 bytes
128 kbps	160 bytes

Table 7 Recommended Data Segmentation Sizes (continued)

Port Access Rate	Recommended Data Segmentation Size[1]
256 kbps	320 bytes
512 kbps	640 bytes
1536 kbps (full T1)	1600 bytes
2048 kbps (full E1)	1600 bytes

1. The data segmentation size is based on back-to-back Frame Relay. If traffic is sent through an IGX with standard Frame Relay, subtract 6 bytes from the recommended data segmentation size.

Configuring FRF.5 for Voice

If you are configuring FRF.5 Frame Relay-ATM Network Interworking for voice traffic, then you need to configure the voice-network dial peers to support Frame Relay-ATM Interworking. Configure the POTS dial peers for the PBX or telephony devices attached to the local voice ports. For more information about dial peers, see the *Cisco IOS Multiservice Applications Configuration Guide*.

To configure POTS dial peers, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`router(config)# dial-peer voice` *tag* `pots`	Defines a POTS peer and enters dial-peer configuration mode. The *tag* argument uniquely identifies the dial peer.
Step 2	`router(config-dialpeer)# destination-pattern` *string*	Configures the destination pattern of the dial peer.
Step 3	`router(config-dialpeer)# port` *slot/port*	Associates this voice-telephony dial peer with a specific logical dial interface. Enter the *slot/port* number of the voice port connected to the POTS dial peer.
Step 4	`router(config-dialpeer)# preference` *value*	(Optional) Configures preference for the POTS dial peer.
Step 5	`router(config-dialpeer)# forward-digits` {*num-digit* | *all*}	(Optional) Configures the digit-forwarding method that will be used on the dial peer if using digit-forwarding.
Step 6	`router(config-dialpeer)# prefix` *string*	(Optional) Assigns the dialed digits prefix for the dial peer if forward-digiting was not configured.

To configure voice network dial peers for voice over FRF.5 Frame Relay-ATM Network Interworking, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`router(config)# dial-peer voice` *tag* `vofr`	Defines Voice over Frame Relay dial peer. The *tag* argument uniquely identifies the dial peer.
Step 2	`router(config-dialpeer)# destination-pattern` *string*	Configures destination pattern of the dial peer.

	Command	Purpose
Step 3	`router(config-dialpeer)# session target fratm number dlci dlci`	Configures FRF.5 dial peer session target.
Step 4	`router(config-dialpeer)# alt-dial string`	(Optional) Configures alternate dial-out string.

FRF.8 Frame Relay-ATM Service Interworking

Note FRF.8 is supported only on the Cisco MC3810 multiservice access concentrator for Cisco IOS Release 12.1.

This section provides conceptual information about FRF.8 Frame Relay-ATM Service Interworking. To configure FRF.8, perform the tasks in the following sections:

- FRF.8 Concepts
- FRF.8 Configuration Task List

For examples of configuring FRF.8, see the "FRF.8 Configuration Example" section later in this chapter.

Note FRF.8 is supported only over Frame Relay or ATM PVCs. It is not supported on SVCs.

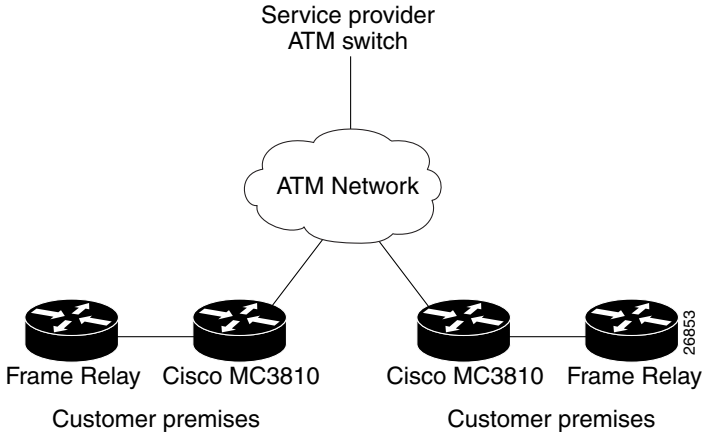
FRF.8 Concepts

Service Interworking connects a Frame Relay network to an ATM network while the networks function independently. Service Interworking (FRF.8) allows bidirectional PVC protocol conversion functions and provides a standards-based solution for service providers, enterprises, and end users.

In Service Interworking translation mode, Frame Relay PVCs are mapped to ATM PVCs without the necessity for symmetric topologies—the paths can terminate on the ATM side. The ATM-connected Cisco MC3810 need not be directly linked to a Frame Relay network. Some network devices in a Frame Relay network can evolve to ATM without all network devices doing so.

In Figure 26, other Frame Relay devices are connected to Cisco MC3810 multiservice access concentrators, which in turn connect to a the ATM network and switch of a service provider.

Figure 26 Service Interworking Function



For further general information about Service Interworking (FRF.8), see the "Wide-Area Networking Overview" chapter at the beginning of this book.

This feature supports two modes of operation of the IWF for upper-layer user protocol encapsulation—transparent mode and translation mode—as defined in FRF.8 section 5.3. The modes are configured at the PVC level. They differ as follows:

- Translation mode maps between ATM and Frame Relay encapsulation; it also supports interworking of routed and/or bridged protocols.
- Transparent mode does not map encapsulations but sends them unaltered. This mode is used when translation is not practical because encapsulation methods do not conform to the supported standards for Service Interworking.

The Service Interworking function in translation mode works like a protocol converter in the following ways:

- When Inverse Address-Resolution Protocol (INARP) or static mapping is configured, addresses are resolved one-to-one between Frame Relay and ATM schemes.
- Header function mapping and multiprotocol data unit headers are converted between protocols.
- ATM Adaptation Layer 5 (AAL5) information assists in translating boundary information in both directions:
  - In the Frame Relay-to-ATM direction, a frame is mapped to an ATM Adaptation Layer 5 (AAL5) protocol data unit (PDU).
  - In the ATM-to-Frame Relay direction, the AAL5 information is used to delineate frame boundaries and insert flags and other information that is stripped from frames in the opposite direction.
- Discard Eligibility (DE) and Cell Loss Priority (CLP) can be mapped in both directions.
- Mapping can occur between the Frame Relay Forward Explicit Congestion Notification (FECN) and the ATM Explicit Forward Congestion Indicator (EFCI) in both directions, depending upon the configuration. In some cases, it may be desirable for the mapping to occur, but in many cases it is better to turn the mapping off. This is configurable on each PVC.
- Mapping occurs between the Frame Relay Command Response (C/R) field and the ATM common part convergence sublayer user-to-user least significant bit (CPCS-UU LSB), as defined in FRF.8.
- PVC Management interworking is supported, as defined in FRF.8 section 5.2. The optional asynchronous Local Management Interface (LMI) status message is not implemented.

FRF.8 Configuration Task List

To configure Service Interworking (FRF.8) Frame Relay-ATM Service Interworking, perform the tasks in the following sections:

- Configuring the ATM Interface and PVCs (Required)
- Verifying ATM Interface and PVC Configuration (Optional)
- Configuring the Frame Relay Interface and PVCs (Required)
- Verifying Frame Relay Interface and PVC Configuration (Optional)

Configuring the ATM Interface and PVCs

To configure ATM interface and PVCs and set up those interfaces with ATM PVCs that interwork with Frame Relay PVCs, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# controller {T1 | E1} 0`	Enters controller configuration mode for controller T1/E1 0. ATM traffic is supported on controller T1/E1 0 only.
Step 2	`Router(config-controller)# framing esf`	Sets extended superframe (ESF) format for ATM (automatic when the ATM mode is set).
	or	
	`Router(config-controller)# framing crc4`	Sets cyclic redundancy check (CRC4) format for ATM (automatic when the ATM mode is set).
Step 3	`Router(config-controller)# linecode b8zs`	Sets line code to binary 8-zero substitution (B8ZS) for ATM on T1 (automatic when the ATM mode is set).
	or	
	`Router(config-controller)# linecode hdb3`	Sets line code to high-density bipolar-3 zeros (HDB3) for ATM on E1.
	or	
	`Router(config-controller)# mode atm`	Indicates the controller supports ATM encapsulation, and creates virtual ATM interface 0 for ATM PVCs.
	or	
	`Router(config-controller)# interface atm0`	Enters interface configuration mode for ATM interface 0.
	or	
	`Router(config-if)# pvc [name] vpi/vci`	Creates an ATM PVC and enters configuration mode.
	or	
	`Router(config-if-atm-pvc)# oam-pvc [manage] [frequency]`	Enables operations, administration & maintenance (OAM) PVC management. To permit PVC management, you must also enable keepalive on the serial interface. See Step 5 of the "Configuring the Frame Relay Interface and PVCs" section later in this chapter.
	or	
	`outer(config-if-atm-pvc)# encapsulation aal5 mux fr-atm-srv`	Sets encapsulation of the ATM PVC.

Verifying ATM Interface and PVC Configuration

To verify configuration of ATM interface 0 and the PVCs you have created, perform the following steps:

Step 1 Use the **show interface atm0** command to verify configuration of the ATM interface. Important information appears in bold. Note that the total count of configured VCs is shown.

```
router# show interface atm0
ATM0 is up, line protocol is up
  Hardware is PQUICC Atom1
  MTU 3000 bytes, sub MTU 3000, BW 1536 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s):, PVC mode
  1024 maximum active VCs, 11 current VCCs
  VC idle disconnect time: 300 seconds
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 1000 bits/sec, 1 packets/sec
     2838 packets input, 971318 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     201591 packets output, 16783240 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Step 2 Use the **show atm pvc** command to verify the PVCs you created. Note that in this example, PVC 10 is set up for Network Interworking; the other PVCs are configured for Service Interworking.

```
router# show atm pvc
            VCD /                                          Peak  Avg/Min Burst
Interface   Name       VPI   VCI  Type   Encaps   SC     Kbps   Kbps   Cells  Sts
0           2           24    36   PVC    FRATMSRV UBR       0                DOWN
0           1           24    37   PVC    FRATMSRV UBR       0                  UP
0           9           44    44   PVC    FRATMSRV UBR       0                DOWN
0           11          94    92   PVC    FRATMSRV UBR       0                  UP
0           3          100   100   PVC    FRATMSRV UBR      56                DOWN
0           6          120   120   PVC    FRATMSRV UBR       0                  UP
```

Configuring the Frame Relay Interface and PVCs

To configure the Frame Relay interface for Service Interworking and set up Frame Relay PVCs to work with ATM PVCs, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# network-clock base-rate {56k | 64k}`	Configures the network clock base rate for serial ports; the default setting is 56 kbps.
Step 2	`Router(config)# frame-relay switching`	Enables PVC switching on the serial interfaces.

Step 3	`Router(config)# interface serial {0 | 1}`	Specifies a serial interface for Frame Relay PVCs and enters configuration mode.
Step 4	`Router(config-if)# encapsulation frame-relay [cisco | ietf]`	Specifies the Frame Relay encapsulation on the interface. Use **ietf** to allow FRF.8 communications in translation mode. Use the default **cisco** option when Cisco devices are communicating in transparent mode.
Step 5	`Router(config-if)# keepalive [number]`	Enables the keepalive timer.
Step 6	`Router(config-if)# frame-relay intf-type {dce | dte | nni}`	(Optional) Sets the switch type.
Step 7	`Router(config-if)# frame-relay lmi-type {ansi | cisco | q933a}`	(Optional) Unless this command is set, LMI autosensing automatically selects a method for addressing the LMI. If you connect to the public data network (PDN), the LMI type must match the type used on the PDN. Otherwise, you can specify a parameter that suits the needs of your private network.
Step 8	`Router(config-if)# frame-relay pvc dlci service {transparent | translation} [clp-bit {0 | 1 | map-de}][de-bit {0 | 1 | map-clp}] [efci-bit {0 | 1 | map-fecn}] interface atm0 {vpi/vci | vcd}`	Sets up Frame Relay PVCs for Frame Relay-ATM Service Interworking. Repeat this step for each PVC that you wish to set up. The last part of the command maps the Frame Relay PVC to an ATM PVC by specifying the ATM interface (0 is the only value), and either the ATM virtual circuit descriptor (VCD), or the VPI-VCI pair for the PVC.

Verifying Frame Relay Interface and PVC Configuration

To verify configuration of Frame Relay interface 0 and the PVCs you have created, perform the following steps:

Step 1 Use the **show interface serial** command to confirm serial interface configuration for Frame Relay. Note that some important text appears in bold:

- Encapsulation is set to IETF, and the default keepalive is in effect. These settings allow translation mode and management of PVCs, respectively.

- The LMI type of the Consultative Committee for International Telegraph and Telephone (CCITT) was specified with the **q933a** keyword. The Frame Relay switch type is DCE.

```
router# show interface serial0
Serial0 is up, line protocol is up
  Hardware is PQUICC Serial
  MTU 5000 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation FRAME-RELAY IETF, crc 16, loopback not set
  Keepalive set (10 sec)
  Scramble enabled
  LMI enq sent  0, LMI stat recvd 0, LMI upd recvd 0
  LMI enq recvd 36108, LMI stat sent  36108, LMI upd sent  0, DCE LMI up
  LMI DLCI 0  LMI type is CCITT  frame relay DCE
  FR SVC disabled, LAPF state down
  Broadcast queue 0/64, broadcasts sent/dropped 0/0, interface broadcasts 0
  Last input 00:00:02, output 00:00:02, output hang never
  Last clearing of "show interface" counters 4d04h
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/1/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     54846 packets input, 7038195 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 8 giants, 0 throttles
     9 input errors, 0 CRC, 1 frame, 0 overrun, 0 ignored, 0 abort
     36436 packets output, 1599185 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
  Cable attached: V.35 (DTE)
Hardware config: V.35; DTE;  DSR = UP   DTR = UP   RTS = UP   CTS = UP   DCD = UP
```

Note For a description of each output display field, refer to the **show interface serial** command reference page in the *Cisco IOS Interface Command Reference* publication.

Step 2 Use the **show frame-relay pvc** [*type number* [*dlci*]] command to see status and traffic information about Frame Relay PVCs that you have configured. The *type*, *number*, and *dlci* arguments are optional and allow you to specify the switch type of the interface, an interface number, and a data-link connection identifier (DLCI) number.

```
Router# show frame-relay pvc dce
PVC Statistics for interface Serial0 (Frame Relay DCE)

DLCI = 100, DLCI USAGE = SWITCHED, PVC STATUS = ACTIVE, INTERFACE = Serial0

  input pkts 4936          output pkts 62           in bytes 989118
  out bytes 63676          dropped pkts 4           in FECN pkts 8
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 8             out DE pkts 0
  out bcast pkts 0          out bcast bytes 0            Num Pkts Switched 4932
  pvc create time 1d16h, last time pvc status changed 1d16h
```

FRF.5 and FRF.8 Configuration Examples

The following sections provide examples to help you understand how to configure FRF.5 Frame Relay-ATM Network Interworking and FRF.8 Frame Relay-ATM Service Interworking:

- FRF.5 Configuration Examples
- FRF.8 Configuration Example

FRF.5 Configuration Examples

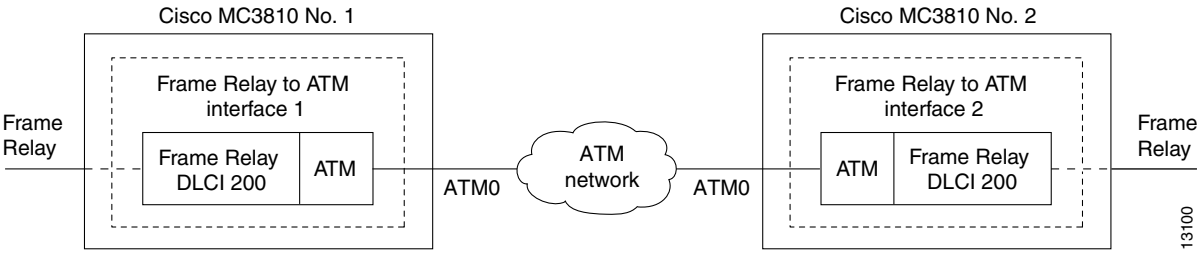
This section contains the following examples of FRF.5 Frame Relay-ATM Network Interworking:

- FRF.5 Example (Data Traffic Only)
- FRF.5 Example (Data and Voice Traffic)

FRF.5 Example (Data Traffic Only)

The following example shows a Frame Relay-ATM Interworking configuration for two Cisco MC3810 concentrators exchanging data traffic only. Figure 27 shows the network configuration.

Figure 27 FRF.5 Example for Data Traffic Only



Configuration for Cisco MC3810 No. 1

```
hostname Router
no aaa per-user
controller T1 0
 mode atm

interface Ethernet0
 ip address 209.165.200.225 255.255.255.224
 no ip mroute-cache
 no ip route-cache

interface ATM0 point-to-point
 ip address 209.165.201.1 255.255.255.224
 no ip mroute-cache
 no ip route-cache
 map-group atm1
 pvc 1 1 200
 encapsulation aal5mux frame-relay
 pvc 26 26 200
 encapsulation aal5snap
```

```
interface FR-ATM1
 ip address 209.165.201.2 255.255.255.224
 encapsulation frame-relay
 frame-relay map ip 209.165.200.226 200 broadcast
 fr-atm connect dlci 200 ATM0 1
interface FR-ATM20

 no keepalive

no ip classless
map-list atm1
ip 209.165.201.3 atm-vc 26 broadcast
```

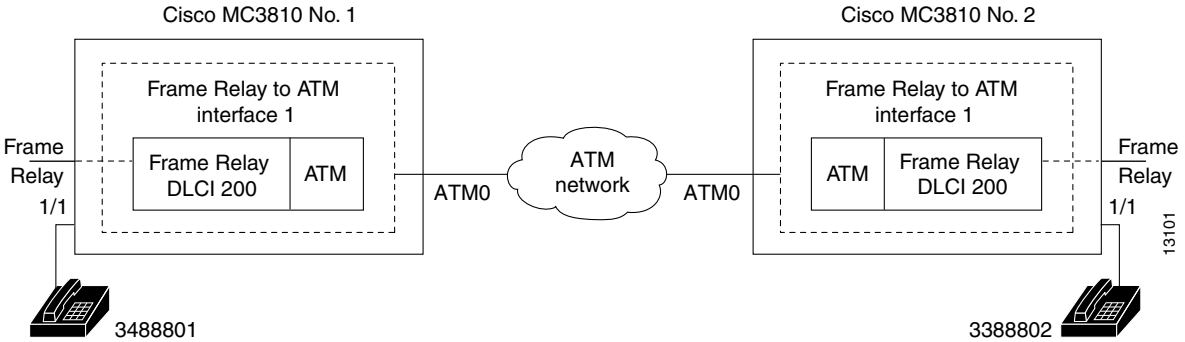
Configuration for Cisco MC3810 No. 2

```
hostname Router
controller T1 0
 mode atm

interface Ethernet0
 ip address 209.165.202.129 255.255.255.224
 no ip mroute-cache
 no ip route-cache
 ipx network 123

interface Serial0
 no ip address
 no ip mroute-cache

interface Serial1

interface ATM0 point-to-point
 ip address 209.165.200.225 255.255.255.224
 no ip mroute-cache
 encapsulation atm
 no ip route-cache
 map-group atm1
 pvc 1 1 200
 encapsulation aal5mux frame-relay
 pvc 26 26 200
 encapsulation aal5snap

interface FR-ATM2
 ip address 209.165.200.227 255.255.255.224
 encapsulation frame-relay
 frame-relay map ip 209.165.200.227 200 broadcast
fr-atm connect dlci 200 ATM0 1
interface FR-ATM20
no keepalive
map-list atm1
 ip 209.165.200.228 atm-vc 26 broadcast
```

FRF.5 Example (Data and Voice Traffic)

The following example shows a Frame Relay-ATM Interworking configuration for two Cisco MC3810 concentrators exchanging both data and voice traffic. Figure 28 shows the network configuration.

Figure 28 FRF.5 Example for Data and Voice Traffic



Configuration for the Cisco MC3810 No. 1

```
hostname Router
controller T1 0
 mode atm

interface Ethernet0
 ip address 209.165.200.225 255.255.255.224
 no ip route-cache
 no ip mroute-cache
 no cdp enable

interface ATM0
 ip address 209.165.201.1 255.255.255.224
 no ip route-cache
 no ip mroute-cache
 map-group atm1
 atm enable-payload-scrambling
 pvc 1 1 200
 encapsulation aal5mux frame-relay
 pvc 26 26 200
 encapsulation aal5snap

interface FR-ATM 1
 ip address 209.165.201.2 255.255.255.224
 encapsulation frame-relay
 no ip mroute-cache
 frame-relay interface-dlci 200 voice-encap 512
 no keepalive
 frame-relay lmi-type ansi
 fr-atm connect dlci 200 ATM0 1
interface FR-ATM20

map-list atm1
 ip 209.165.200.226 atm-vc 26 broadcast
no cdp run

voice-port 1/1
```

```
voice-port 1/2

voice-port 1/3

voice-port 1/4

voice-port 1/5

voice-port 1/6

dial-peer voice 1 pots
 destination-pattern 3488801
 port 1/1

dial-peer voice 1001 vofr
 destination-pattern 338....
 session target FR-ATM1 200
```

Configuration for Cisco MC3810 No. 2

```
hostname Router
controller T1 0
 mode atm

interface Ethernet0
 ip address 209.165.202.129 255.255.255.224

interface ATM0
 ip address 2
 map-group atm1
 atm enable-payload-scrambling
 pvc 1 1 200
 encapsulation aal5mux frame-relay
 pvc 26 26 200
 encapsulation aal5snap

interface FR-ATM 1
 ip address 209.165.200.226 255.255.255.224
 encapsulation frame-relay
 no ip mroute-cache
 frame-relay interface-dlci 200 voice-encap 512
 no keepalive
 fr-atm connect dlci 200 ATM0 1
interface FR-ATM20

ip classless

map-list atm1
 ip 209.165.200.227 atm-vc 26 broadcast

voice-port 1/1

voice-port 1/2

voice-port 1/3

voice-port 1/4

voice-port 1/5

voice-port 1/6
```

```
dial-peer voice 1 pots
 destination-pattern 3388801
 port 1/1

dial-peer voice 1001 vofr
 destination-pattern 348....
 session target FR-ATM1 200
```

FRF.8 Configuration Example

This section provides a configuration example where both sides of the Frame Relay-ATM Service Interworking function are performed on the same Cisco MC3810 multiservice access concentrator, which is acting as a gateway to mediate traffic between the two transport methods.

A serial interface is configured for Frame Relay with Frame Relay PVCs, and an ATM interface is configured on the same Cisco MC3810.

```
Current configuration:
!
version 12.0
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname iwf
!
!
network-clock base-rate 56k
ip subnet-zero
```

This command enables Frame Relay switching on the serial interfaces of the Cisco MC3810:

```
frame-relay switching
!
!
controller T1 0
 framing esf
```

The **mode atm** command is required for ATM service.

```
mode atm
!
!
!
interface Ethernet0
 ip address 1.3.16.1 255.255.0.0
 no ip directed-broadcast
!
```

The following **frame-relay pvc** commands set up Frame Relay PVCs that correspond to ATM PVCs. Although one uses translation mode and one transparent mode, CLP and DE bits are mapped in both directions, corresponding to Mode 1 of the FRF.8 agreement for these parameters.

In the Frame Relay-to-ATM direction, FECN and the ATM EFCI are mapped to one another.

The command points to the ATM PVC that corresponds to the Frame Relay PVC, using the ATM interface number (0) and the VPI/VCI pair as identification.

```
interface Serial0
 mtu 5000
 no ip address
 no ip directed-broadcast
 encapsulation frame-relay IETF
 frame-relay pvc 44 service transparent clp-bit map-de de-bit map-clp efci-bit map-fecn
interface ATM0 44/44
 frame-relay pvc 120 service translation clp-bit map-de de-bit map-clp efci-bit map-fecn
interface ATM0 120/120
!
```

The **frame-relay lmi-type** command is set to the type defined by ITU-T Q.933 Annex A.

```
frame-relay lmi-type q933a
```

The **frame-relay intf-type** command designates digital communications equipment (DCE), because the Cisco MC3810 is acting as a switch connected to a router rather than being connected directly to a Frame Relay network.

```
 frame-relay intf-type dce
!

interface Serial1
 no ip address
 no ip directed-broadcast
 shutdown
!
```

The ATM PVCs are created on interface ATM 0, the only available interface for this purpose. The **oam-pvc** setting provides for loopback testing and PVC management on PVC 44/44.

Note that these PVCs are specified in the **frame-relay pvc** commands that are configured on serial interface 0. Encapsulation is set for Service Interworking.

Because the interworking function is used for data transfer, unspecified bit rate (UBR) can be configured as the quality of service (QoS) class for a PVC, as in PVC 44/44. The peak cell rate for output is set at 56 kbps.

```
interface ATM0
 mtu 3000
 no ip address
 no ip directed-broadcast
 no atm ilmi-keepalive

 pvc 120/120
  encapsulation aal5mux fr-atm-srv
 !
 pvc 44/44
  ubr 56
  oam-pvc manage
  encapsulation aal5mux fr-atm-srv
 !
```

The balance of the configuration does not affect Frame Relay-to-ATM interworking.